

What is claimed is:

1. A chemical sensing element for sensing a chemical, the chemical sensing element comprising:

a microcantilever beam; and

a dense reactive layer that specifically absorbs the chemical, wherein the reactive layer is deposited on the microcantilever beam and configured to resist relaxation and to expand as it absorbs the chemical, thereby causing the microcantilever beam to deflect and allowing the presence of the chemical to be sensed..

2. A chemical sensing element according to claim 1 wherein the reactive layer is deposited and densified on the microcantilever beam through physical vapor deposition with concurrent ion bombardment.

3. A chemical sensing element according to claim 2 wherein the concurrent ion bombardment is performed using a secondary ion source.

4. A chemical sensing element according to claim 2 wherein the physical vapor deposition is a process selected from the group consisting of thermal evaporation, electron evaporation, and ion beam evaporation.

5. A chemical sensing element according to claim 1 wherein the reactive layer is deposited and densified on the microcantilever beam through sputter deposition with concurrent ion bombardment of the reactive layer.
6. A chemical sensing element according to claim 5 wherein the sputter deposition process is selected from the group consisting of RF diode sputtering, magnetron sputtering with an applied substrate bias, and unbalanced magnetron sputtering.
7. A chemical sensing element according to claim 1 wherein the dense reactive layer is applied on the microcantilever beam using physical vapor deposition with concurrent heating of the microcantilever beam.
8. A chemical sensing element according to claim 1 wherein the dense reactive layer is applied on the microcantilever beam using sputter deposition with concurrent heating of the microcantilever beam.
9. A chemical sensing element according to claim 1 wherein the reactive layer comprises palladium, a palladium alloy, platinum, or a platinum alloy.
10. A chemical sensing element according to claim 1 wherein the reactive layer has a thickness of between about 10 nm and about 100 nm.

11. A chemical sensor comprising:
 - a. a chemical sensing element for sensing a chemical, the chemical sensing element comprising:
 - a microcantilever beam; and
 - a dense reactive layer that specifically absorbs the chemical, wherein the reactive layer is deposited on the microcantilever beam and configured to resist relaxation and to expand as it absorbs the chemical, thereby causing the microcantilever beam to deflect and allowing the presence of the chemical to be sensed;
 - b. a stationary baseplate positioned adjacent to the microcantilever beam such that a condition that exists between the microcantilever beam and the baseplate can change when the reactive layer absorbs the chemical and causes the microcantilever beam to deflect; and
 - c. a sensing circuit for measuring a change caused by deflection of the microcantilever beam in response to the reactive layer absorbing the chemical, wherein a change in capacitance is indicative of an amount of the chemical in a gas exposed to the sensor.
12. A chemical sensor according to claim 11 wherein the sensing circuit comprises a sensing circuit selected from the group consisting of a capacitance sensing circuit for measuring a change in capacitance caused by deflection of the microcantilever beam, a piezoresistance sensing circuit for measuring a piezoresistive change caused by deflection of the microcantilever beam, and an optical lever for measuring deflection of the microcantilever beam.

13. A chemical sensor according to claim 11 further comprising a processor for determining the amount of the chemical based on the amount of deflection of the microcantilever beam.

14. A chemical sensor according to claim 13 further comprising a temperature sensor for measuring temperature interference, and wherein the processor is configured to correct the determined amount of the chemical based on the measured temperature interference.

15. A chemical sensor according to claim 13 further comprising a humidity sensor for measuring humidity interference, and wherein the processor configured to correct the determined amount of the chemical based on the measured humidity interference.

16. A chemical sensor according to claim 11 further comprising a reference sensor for providing a baseline reference, wherein the reference sensor comprises a microcantilever beam without a reactive layer.

17. A chemical sensor according to claim 11 further comprising a transmitter for transmitting data comprising the amount of the chemical to a receiver positioned at a location remote from the sensor.

18. A chemical sensor according to claim 17 wherein the sensor further comprises a receiver configured to receive control signals from a transmitter positioned at a location remote from the sensor.

19. A chemical sensor according to claim 11 comprising a plurality of chemical sensing elements arranged in a sensor array.

20. A method for depositing a dense reactive layer onto a substrate for chemical sensing, the method comprising:

using a deposition method for depositing the reactive layer onto the substrate; and
using a densifying method for concurrently densifying the reactive layer during the deposition method.